Santee Cooper

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VIA E-MAIL

September 9, 2008

Joe Eller
BAQ Permitting
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
ellerjc@dhec.sc.gov

RE: *Santee Cooper Pee Dee Case-by-Case MACT Mercury Variability Calculations*

Dear Mr. Eller:

This letter provides additional information that you have requested in regards to calculations of mercury emissions variability from similar sources that were submitted with the Santee Cooper Pee Dee Case-by-Case MACT Permit Application. Specifically, Santee Cooper is providing the following additional information for your consideration:

- Alternate mercury variability calculations to provide estimates of the EPA-NACAA approach for units with an FF-SDA control device configuration without utilizing these chlorine curves. This alternative calculation for these sources should involve the use of "no correlation equation" approach based on stack tests average emissions, stack test results standard deviation, and a z-statistic for a one-sided z-test confidence interval.

- Mercury variability calculations that apply the EPA methodology to sources that were not in EPA's top performing sources (*e.g*, SEI Birchwood, Intermountain, Logan, Salem Harbor, and Clover).

A summary of the results from performing the requested DHEC calculations for candidate sources is provided in the attached table. Further discussion is provided below on how Santee Cooper performed each of these mercury calculations.

Alternate Mercury Variability Method

The statutory basis for setting the floor is a requirement that the emission limitation for new sources "not be less stringent than the emission control that is achieved in practice by the best controlled similar source."[1] Courts have interpreted the term "achieved in practice" by stating, "EPA would be justified in setting the floors at a level that is a reasonable estimate of the performance of the 'best controlled similar unit' under the reasonably foreseeable circumstances."[2] In establishing a MACT floor for electric utility steam generating units, EPA

[1] Clean Air Act, Section 112(d)(3).

[2] *Sierra Club and NRDC v. USEPA*, (Municipal Waste Incinerators) 167 F.3d 658, March 2, 1999.

stated, "For combustion sources such as Utility Units, variability in both the mercury (Hg) or nickel (Ni) content of the fuel combusted and the performance of a particular control device have a significant impact on the determination of the level of emission limitation actually being achieved." EPA also noted that "Variability is inherent whenever measurements are made or whenever mechanical processes operate. Variability in emission test data may arise from one or more of the following areas:

(1) The emission test method(s);
(2) The analytical method(s);
(3) The design of the unit and control device(s);
(4) The operation of the unit and control device(s);
(5) The amount of the constituent being tested in the fuel; and
(6) Composition of the constituents in the fuel and/or stack gases.

Test and analytical method variability can be quantified by statistical analysis of the results of a series of tests. The results can be analyzed to establish confidence intervals within which the true value of a test result is presumed to lie."[3] Although for the utility rule EPA focused primarily on mechanisms by which fuel constituents could result in variability in emissions, Santee Cooper has evaluated variability using multiple approaches and based its recommended MACT floor upon the worst reasonably foreseeable circumstances that resulted from this multi-pronged approach. Where EPA had developed and applied an algorithm relating emissions variability to multiple fuel characteristics (mercury and chlorine content), Santee Cooper used that same approach for calculating variability under the Prong 1, or "EPA-NACAA" approach. Where no relationship between emissions and fuel chlorine content had been established by EPA, Santee Cooper accounted for process variability by a statistical analysis of test results, similar to that described above by EPA, and reflecting a methodology proposed by NACAA. This response evaluates the results of using the statistical analysis of test results for units where there was a valid algorithm which predicted variability due to multiple fuel characteristics.

Based on an analysis of data in the ICR-3 database, EUSGU firing bituminous coal that utilized a fabric filter and spray dryer absorber (FF-SDA) control device configuration showed a strong statistical correlation between chlorine concentration in coal and expected mercury removal rates when using an algorithm in the form:[4]

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[3] Proposed National Emission Standards for Hazardous Air Pollutants: Electric Utility Steam Generating Units: 69FR4670, January 30, 2004.

[4] WEST Associates, *Multivariable Method to Estimate the Mercury Emissions of the Best-Performing Coal-Fired Utility Units Under the Most Adverse Circumstances Which Can Reasonably Be Expected to Recur*; prepared by ENSR Corporation, March 4, 2003; Statistical Analysis.

$$F_r = 1 - \beta \times \exp(-\alpha \times C_{Cl})$$

Where

F_r = fraction of mercury removed during the ICR stack test
C_{Cl} = chlorine concentration in the test coal (ppm)

Santee Cooper adopted the use of the chlorine algorithms, where possible, to also define process control variability in both the EPA-NACAA approach and the EPA-DOE approach. Santee Cooper has used these algorithms when statistically relevant because they are based on multiple stack tests from several sources in the ICR-3. As such, these chlorine curves are considered an appropriate estimate of process control variability, as a function of chlorine.

In response to DHEC's request, the attached table includes alternate variability calculations to provide estimates of the EPA-NACAA approach for units with an FF-SDA control device configuration without utilizing these chlorine curves (applied the modified approach to ICR-3 data for Mecklenburg GEN1, Dwayne 2B, SEI – Birchwood 1, and Logan GEN1). In general, both the fuel variability approach in the EPA-NACAA approach, and the variability approach reflecting the EPA-DOE approach projected foreseeable conditions that would result in higher emission rates than the rate predicted by examining test method-related variability. However, for one unit, the Logan plant, the conditions associated with test-method variability resulted in an emission rate that fell between the rates predicted by the other two approaches to variability examined by Santee Cooper.

EPA Variability Method for Additional Sources

EPA applied variability calculations to the top 12% of bituminous coal-fired EUSGU (the top sources determined by the single stack test average in the ICR-3 database for each source) – for this sample size, EPA evaluated the top four (4) sources. DHEC has requested that Santee Cooper apply the same mercury variability calculation methodology EPA used to the top sources (Mecklenburg GEN1, Dwayne 2B, and Valmont 5 as the candidate sources included in the Pee Dee Application) to additional sources in the ICR-3 database, specifically: SEI – Birchwood 1, Intermountain 2SGA, Logan GEN1, Salem Harbor 3, and Clover 2. The attached table includes these results.

In general, the approach EPA used in the 2004 proposed rule (based on variability in fuel characteristics) produced relatively high emission rate floors for units for which EPA had an algorithm that reflected the influence of coal chlorine content on mercury emissions. For the units where EPA had been unable to establish such a relationship between emissions and chlorine content, the conditions examined by EPA did not result in as much variability as other approaches to predicting worst foreseeable conditions used by Santee Cooper, including the EPA-DOE approach and the test method variability approach derived from EPA-NACAA.

If you have any additional questions, please contact Julie Jordan Metts, P.E. at (843) 761-8000, extension 4688.

Sincerely,

Jay Hudson, P.E.
Manager
Environmental Management

JH:JJM

A50-43110

ATTACHMENT

Summary of Variability Calculation Approaches (and Modified Approaches by Request) of Similar Sources

Summary of Variability Calculations of Similar Sources

		Stack Test Hg Emissions		Statistical Variability Options[3]						September 4, 2008 DHEC Requested Calculations[4]					
				EPA - NACAA Approach			EPA - DOE Approach			Alt. Hg Variability Method			EPA Method - Additional Sources		
Similar Source	Control Configuration	(lb/TBtu)[1]	% Removal[2]	alpha	beta	(lb/TBtu)	alpha	beta	(lb/TBtu)	alpha	beta	(lb/TBtu)	alpha	beta	(lb/TBtu)
Mecklenburg	FF-SDA	0.1062	98.81%	0.0022	0.8188	1.8051	0.0022	0.8188	2.0641	-	0.0155	0.2316	-	-	-
Dwayne	FF-SDA	0.1074	93.66%	0.0022	0.8188	1.2376	0.0022	0.8188	2.0641	-	0.0755	0.9140	-	-	-
Valmont	FF	0.1268	86.52%	-	0.2272	1.1706	-	0.1348	3.3239	-	-	-	-	-	-
SEI - Birchwood	FF-SDA	0.2379	97.36%	0.0022	0.8188	3.9538	0.0022	0.8188	2.0641	-	0.0594	1.3366	0.0022	0.8188	3.9538
Intermountain	FF-WS	0.2466	83.84%	-	0.2880	1.6896	-	0.1616	3.9848	-	-	-	-	0.1616	0.9415
Logan	FF-SDA	0.2801	97.52%	0.0022	0.8188	1.1045	0.0022	0.8188	2.0641	-	0.0724	1.6152	0.0022	0.8188	1.1045
Salem Harbor	ESP(CS)	0.3348	89.88%	-	0.1963	1.5155	-	0.1012	2.4954	-	-	-	-	0.1012	0.7813
Clover	FF-WS	0.3529	96.71%	-	0.0712	1.0654	-	0.0329	0.8113	-	-	-	-	0.0329	0.4925

1. From ICR III data at the CAMR and Utility MACT webpage [icrdata.xls] referenced at www.epa.gov/ttn/atw/combust/utiltox/utoxpg.html, and presented as worksheets 'summary data', 'definitions', and 'detail data' in this spreadsheet.
2. The removal rate is based on the removal percent as tested around the last control device, as determined from measured emissions during stack testing based on f factors. Note, the removal rate for the control configurations with WS are based on the coal-to-stack removal percent.
3. For a description of the variability prongs and the statistical analyses or each, refer to the description provided in the Pee Dee Case-by-Case MACT Permit Application submitted to DHEC on June 30, 2008. See separate worksheets for the variability calculation for each similar source under each variability prong.
4. Calculations performed and presented here in response to an email request from DHEC on September 4th, 2008 (Mr. Joe Eller, DHEC, to Mr. Jay Hudson and Ms. Julie Metts, Santee Cooper).